MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

EME4066 –OPERATIONS RESEARCH

(ME)

5 MARCH 2019
9.00 am - 11.00 am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 6 pages including the cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) Air Asia recently has purchased few Boeing plane. The Boeing plane comes with three compartment, front, center and back. Each compartment has a capacity limitation on the space and weight which are tabled in Table 1.

Table 1

Compartment	Weight capacity (kg)	Space capacity (m^3)
Front	15	7500
Center	18	8400
Back	16	3800

Additionally, in order to maintain the balance of the Boeing plane, the weight of the Boeing plane in the respective compartments must be the same proportion of that compartment's weight capacity.

The following four Boeing plane have been offered for shipment on an upcoming flight as space is available:

Boeing plane	Weight (kg)	Volume (m^3/kg)	Profit (RM/kg)
1	30	750	550
2	24	630	364
3	15	275	740
4	22	573	290

Any portion of these Boeing plane can be accepted. The objective is to determine how much each plane should be accepted and how to distribute each among the compartment to maximize the total profit for the flight.

Formulate a linear programming model for this problem. **[10 marks]**

Continued . . .

(b) Consider the following linear programming problem;

$$Max\, z = 5x_1 + 8x_2$$

subject to

$$x_1 + x_2 \leq 6$$
$$5x_1 + 9x_2 \leq 45$$

$x_1, x_2 \geq 0$ *and integer*

(i) Determine the optimal solution using graphical method **[7 marks]**

(ii) Using Branch and Bound method, obtain the optimal solution. **[8 marks]**

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QUESTION 2

(a) Subway are planning to introduce three new sandwiches honey chicken, roasted ham and spicy mayo tuna for the upcoming Christmas festive season. Each of the sandwiches have to be prepared with sufficient key nutritional requirements. Hence the management team has obtained the following nutritional ingredients and net profit for each item sold which is detailed in Table 2.

Table 2

Nutritional ingredient	Grams per meal			Daily requirement available (Grams)
	Honey chicken	Roasted ham	Spicy mayo tuna	
Vitamins	1	2	1.5	12000
Protein	2/3	2/3	1	4600
Carbohydrates	0.5	1/3	0.5	2400
Net profit	RM 11	RM 16	RM 15	

(i) Formulate the linear programming model for the above scenario **[4 marks]**
(ii) Determine the optimal solution by using simplex method **[11 marks]**

(b) Proton are in the verge of producing three new parts A, B and C where these parts are mainly made of thermoplastics and composites materials. These parts are mainly associated in the internal design of the automotive car. The company operation director is more interested to optimize the production of producing these three new products so that they can sell and gain as much as possible the profit. Table 3 represents the allocation of material with respective to each part and also the allowable constraint for each material.

Table 3

Material	Part A (kg/unit)	Part B (kg/unit)	Part C (kg/unit)	Allowable resources (kg)
Thermoplastics	50	26	38	550
Composites	63	0	12	305
Profit (RM/kg)	RM 200	RM 140	RM 250	

Based on the above problem;

(i) Formulate the primal linear programming for the above problem **[5 marks]**
(ii) Formulate the dual problem for above linear programming problem **[5 marks]**

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QUESTION 3

(a) YTL is one of the major supplier for cement industry. They transport cement from three different plants which are Plant 1, 2 and 3 to three construction sites A, B and C. The cost of transporting 1 ton of cement from each plant to each site are summarized in Table 4. The unit of transportation costs are in RM.

Table 4

Construction sites	Plant			Supply
	1	2	3	
A	5	4	3	100
B	8	4	3	300
C	9	7	5	300
Demand	300	200	200	

YTL seek out for the minimum cost shipping schedule between the plants and construction sites. Find the initial feasible solution by using

(i) Northwest Corner method **[3 marks]**

(ii) Vogel Approximation's method **[3 marks]**

(iii)By using the stepping stone solution method find the optimal solution. Use the solution from Vogel Approximation's method. **[9 marks]**

(b) In a printing shop operation, four jobs may be performed on any of four machines. The hours required for each machine are presented in Table 5. The plant supervisor would like to assign jobs so that the total time in minimized. Use the Hungarian method to obtain the optimal solution. **[10 marks]**

Table 5

Job	Machine (hrs)			
	I	II	III	IV
A	10	14	16	13
B	12	13	15	12
C	9	12	12	11
D	14	16	18	16

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QUESTION 4

(a) AIA has come up with three new policies depending on the nature of the customer. They have conducted survey on the public regarding on the policies and based on that few alternatives were selected on how they want to market the policies based on the nature of customer. Based on the survey result, the company manager has table up the expected payoff based on the nature of the customer against the alternatives of selling the policies. The expected payoff (in units of RM) is detailed in Table 6.

Table 6

Alternatives	State of Nature of Customer		
	S_1	S_2	S_3
A_1	50	100	75
A_2	0	10	125
A_3	20	40	35
Prior probability	0.5	0.3	0.2

The company manager has to decide which alternative is the best based on the decision criteria as below;

(i) Minimax Regret Criterion **[5 marks]**
(ii) Hurwicz criterion **[5 marks]**
(iii) Find EVPI **[7 marks]**

(b) Table 7 shows the payoff for a game between player 1 and player 2

Table 7

	Strategy	Player 2		
		1	2	3
Player 1	1	1	-1	1
	2	-2	0	3
	3	3	1	2

Use the minimax criterion to find the best strategy for each player. Does this game have a saddle point? **[8 marks]**

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